the years 2017 and 2018 found that US women had approximately 22% less dietary intake of magnesium than is the Recommended Dietary Allowance in relation to magnesium intake in pregnancy (10). The concentration of magnesium present in the umbilical cord blood is higher than maternal magnesium levels, the placenta is involved in the active transport of magnesium, and according to Jouanne et al. (2021), 50% of the dietary magnesium is absorbed (4).

Recommended daily dietary allowance for pregnant women

Magnesium is an important cation (11). Magnesium is also available as a supplement (12), while having significant importance as an electrolyte (13, 14) and also being an essential biogenic element (15). *The recommended dietary allowance in pregnancy is* 350 to 400 mg/day (2). It has been estimated that approximately 10% higher supply of magnesium is needed during pregnancy compared to non-pregnant women (2). Pregnant women can find magnesium-rich food in certain vegetables, fruits, (16) and in dairy or some fish products (17). Low levels of magnesium have been linked to various negative health consequences in the general population (18).

Magnesium formulations, types of salts, and their absorption

Magnesium can be present in different pharmaceutical dosage forms (19). There are different organic and inorganic forms of magnesium and their properties (15). **Table 1** shows magnesium forms (20), their bioavailability, and absorption. Bioavailability is influenced by solubility. Convenient solubility at the point of absorption is crucial for good bioavailability (21).

Magnesium as an electrolyte, mechanism and cellular physiology

Electrolyte and fluid balance are of significant importance in preserving homeostasis (23). Electrolytes are necessary for keeping electrical neutrality in the cells (24). Magnesium is part of neurotransmitter activity and provides muscle and neurological functioning (24). Mg^{2+} is a versatile ion present in the main metabolic and biochemical pathways of the cell (25). Magnesium maintains normal cellular and organ functions (8).

Tab. 1. *Overview of organic and inorganic magnesium salts with a focus on their solubility, bioavailability, and other-related information*

Magnesium salts	Type of magnesium salt	Absorption and bioavailability of magnesium salts
magnesium citrate	OS	■ according to a small study, it is among the most bioavailable forms[20] ■ it is well soluble[21] ■ it is absorbed more completely, more bioavailable[22]
magnesium oxide	IS	■ it has lower solubility in GIT and lower bioavailability[21] ■ it is absorbed less completely and less bioavailable[22]
magnesium chloride	IS	■ well absorbed in GIT[20] ■ lower solubility in GIT[21] ■ absorbed more completely, more bioavailable[22]
magnesium lactate	OS	■ easily absorbed in GIT[20] ■ absorbed more completely, more bioavailable[22]
magnesium malate	OS	■ very well absorbed in GIT[20]
magnesium taurate	OS	■ insufficient data
magnesium L-threonate	OS	■ easily absorbed[20]
magnesium sulfate	IS	■ absorbed less completely, less bioavailable[22]
magnesium glycinate	OS	■ easily absorbed[20] ■ good solubility and good bioavailability[21]
magnesium orotate	OS	■ easily absorbed[20] good solubility and bioavailability[21] ■ dihydrate magnesium orotate showed the highest absorption in an *in vitro* simulated small intestinal environment and excellent *in vitro* dissolution parameters[21]
magnesium carbonate	IS	■ lower solubility in GIT and lower bioavailability[21]
magnesium aspartate	OS	■ good solubility and better bioavailability[21]

Note: Insufficient data: more detailed information that could provide a closer explanation in terms of solubility and bioavailability is not available.
IS – inorganic salt, OS – organic salt, GIT – the gastrointestinal tract

Magnesium pharmacokinetics in pregnancy

Magnesium is primarily absorbed in the small intestine (14) and preserved as a bone mineral (5). Absorption can be decreased by nausea and vomiting (26, 27). During pregnancy, gastric pH is increased (26), intestinal motility is lowered, and blood flow in the intestinal area is increased (26). In terms of magnesium distribution, one-third of serum magnesium is bound to albumin in the general population (28), and it can be influenced by other distribution factors (29). Magnesium distribution is available and described in the case of parenterally administered magnesium sulphate in pregnancy (30). However, sufficient information about magnesium pharmacokinetics after oral administration has been available mainly in healthy male adults (31). Magnesium metabolism and balance are dependent on intestinal absorption, bone turnover, and renal excretion (5, 32); intestinal absorption is not dose-dependent, but it is dependent on magnesium status (5). Serum magnesium concentration is affected by renal magnesium reabsorption (32). Pregnancy leads to changes in the hepatic enzyme activities (33). Maternal endocrinological and nutritional status influence changes in bone mineral content (34). For magnesium elimination, the kidneys are the principal organ that influences magnesium homeostasis (35). Progesterone can produce an increase in renal plasma flow and glomerular filtration rate (36). In pregnancy, there is increased renal output of magnesium (37).

Magnesium pharmacodynamics

Magnesium plays a role in hundreds of reactions within the metabolism, as well as in the excitability of cardiac cells, neural activity, neurotransmitter release, muscle contractions, receptor binding, and others; furthermore, it has a role in bone mineralization, in mitochondrial function, and in ATP (adenosine triphosphate) creation (11, 38, 39).

Aetiology of magnesium deficiency in pregnant women

Various factors can contribute to the aetiology of magnesium deficiency besides pregnancy itself. For this purpose, **Table 2** was created. The table does not summarise all possible aetiologies, and the information was derived from magnesium deficiency in the general population or from sources relevant to pregnancy data.